

CLAIMS

What is claimed is:

1. A laser scanning apparatus scanning a bundle of light rays emitted from a light source of a monolithic multi-beam semiconductor laser in a main scanning direction by being reflected by a polygon mirror, the apparatus comprising:

a first lens to focus the bundle of light rays emitted from the light source and a second lens guiding the bundle of light rays transmitted by the first lens toward a deflection surface of the polygon mirror,

wherein the multi-beam semiconductor laser is installed such that an imaginary line drawn through light emitting points of the laser is inclined with respect to the main scanning direction, the first lens is a convex lens having an anamorphic surface shape on at least one surface focusing the bundle of light rays in front of a slit only in the main scanning direction, and the second lens is a cylindrical lens making the bundle of light rays a bundle of parallel light rays or a bundle of concentrated light rays in the main scanning direction.

2. The laser scanning apparatus of claim 1, wherein the first lens has a surface shape to focus the bundle of light rays on the deflection surface of the polygon mirror through the second lens in a sub-scanning direction which is perpendicular to the main scanning direction.

3. The laser scanning apparatus of claim 2, wherein the first lens has a flat surface portion on which the first lens is installed.

4. The laser scanning apparatus of claim 2, wherein the first lens is made of glass.

5. The laser scanning apparatus of claim 2, wherein the first lens has an anamorphic surface shape at one or more of surfaces facing the slit and facing away from the slit.

6. The laser scanning apparatus of claim 3, wherein the second lens has a curved surface which is an aspherical surface.

7. The laser scanning apparatus of claim 6, wherein the second lens corrects aberration of the bundle of light rays not corrected by the first lens.
8. The laser scanning apparatus of claim 2, further comprising:
a photosensitive body;
wherein an inclination of the polygon mirror is corrected by forming a deflection surface of the polygon mirror and the photosensitive body to be a conjugate function.
9. The laser scanning apparatus of claim 1, wherein the first lens has a flat surface portion on which the first lens is installed.
10. The laser scanning apparatus of claim 9, wherein the second lens has a curved surface which is an aspherical surface.
11. The laser scanning apparatus of claim 2, wherein the second lens has a curved surface which is an aspherical surface.
12. The laser scanning apparatus of claim 2, wherein the bundle of light rays is focused by the first lens in front of the slit in the main scanning direction and then magnified, enlarging a shape of the bundle of light rays incident on the slit.
13. The laser scanning apparatus of claim 12, wherein the bundle of light rays is focused in the sub-scanning direction by the first lens, contracting the shape of the bundle of light rays incident on the slit.
14. The laser scanning apparatus of claim 13, wherein a diameter of the bundle of light rays incident on the slit is horizontally lengthy.
15. The laser scanning apparatus of claim 1, wherein the second lens has a curved surface which is an aspherical surface.
16. The laser scanning apparatus of claim 15, wherein the second lens is made of plastic.

17. The laser scanning apparatus of claim 1, wherein the slit is installed on an incident surface of the second lens.
18. The laser scanning apparatus of claim 1, wherein the slit is oval shaped, 3.2 mm long in the main scanning direction and 1.1 mm long in a sub-scanning direction which is perpendicular to the main scanning direction.
19. The laser scanning apparatus of claim 1, wherein the monolithic multi-beam semiconductor laser is inclined at an acute angle from a horizontal state with respect to the main scanning direction.
20. The laser scanning apparatus of claim 1, wherein an interval between light emitting points of the monolithic multi-beam semiconductor laser is 11 μm .
21. The laser scanning apparatus of claim 1, wherein the slit is installed at any position in front of or behind the second lens.
22. The laser scanning apparatus of claim 1, wherein a surface of the first lens facing away from the slit is an axially symmetrical aspherical surface.
23. The laser scanning apparatus of claim 1, wherein a surface of the second lens facing the first lens is an aspherical cylindrical surface.
24. The laser scanning apparatus of claim 1, wherein a surface of the second lens facing away from the first lens is a flat surface.
25. The laser scanning apparatus of claim 1, wherein the shape of the bundle of light rays on the slit is in a spread state that prevents lowering of a slit transmittance.
26. The laser scanning apparatus of claim 25, further comprising:
an f-theta lens;
wherein the bundle of parallel light rays in the main scanning direction is incident on the f-theta lens.

27. A method of scanning a bundle of light rays emitted from a monolithic multi-beam semiconductor laser in a main scanning direction by reflecting the rays in a polygon mirror, the method comprising:

installing the multi-beam semiconductor laser inclined with respect to the main scanning direction;

focusing the bundle of light rays in front of a slit only in the main scanning direction with a convex lens having an anamorphic surface shape on at least one surface; and

making the bundle of light rays a bundle of parallel light rays, or a bundle of concentrated light rays, in the main scanning direction with a cylindrical lens.

28. A laser printer comprising:

a polygon mirror;

a monolithic multi-beam semiconductor laser emitting a bundle of light rays in a main scanning direction and being scanned by being reflected by the polygon mirror; and

a first lens to focus the bundle of light rays emitted from the multi-beam semiconductor laser and a second lens guiding the bundle of light rays transmitted by the first lens toward a deflection surface of the polygon mirror,

wherein the multi-beam semiconductor laser is installed with an imaginary line drawn through light emitting points of the laser inclined with respect to the main scanning direction, the first lens is a convex lens having an anamorphic surface shape on at least one surface focusing the bundle of light rays in front of a slit only in the main scanning direction, and the second lens is a cylindrical lens making the bundle of light rays a bundle of parallel light rays or a bundle of concentrated light rays in the main scanning direction.

29. A digital copier comprising:

a polygon mirror;

a monolithic multi-beam semiconductor laser emitting a bundle of light rays in a main scanning direction and being scanned by being reflected by the polygon mirror; and

a first lens to focus the bundle of light rays emitted from the multi-beam semiconductor laser and a second lens guiding the bundle of light rays transmitted by the first lens toward a deflection surface of the polygon mirror,

wherein the multi-beam semiconductor laser is installed with an imaginary line drawn through light emitting points of the laser inclined with respect to the main scanning direction, the first lens is a convex lens having an anamorphic surface shape on at least one surface focusing the bundle of light rays in front of a slit only in the main scanning direction, and the second lens is a cylindrical lens making the bundle of light rays a bundle of parallel light rays or a bundle of concentrated light rays in the main scanning direction.

30. A laser scanning apparatus comprising:

a polygon mirror;

a monolithic multi-beam semiconductor laser emitting a bundle of light rays in a main scanning direction, the light rays being scanned by being reflected by the polygon mirror, wherein the multi-beam semiconductor laser is inclined with respect to the main scanning direction; and

a convex lens having an anamorphic shape formed on at least one surface thereof, focusing the bundle of light rays in front of a slit only in the main scanning direction;

wherein the beam incident on the slit is in a spread state only in the main scanning direction.

31. A laser scanning apparatus comprising:

a first lens and a second lens;

wherein the first lens is a convex lens having an anamorphic surface shape at one surface so that a bundle of light rays are focused in front of a slit only in a main scanning direction, and the second lens is a cylindrical lens converting the bundle of light rays to a bundle of parallel light rays, or a bundle of concentrated light rays, in the main scanning direction.